

# Memorandum

**Date:** August 9, 2001

**To:** Alfonso Fera, Larry Teitelbaum

**From:** Asim Sehic

**RE:** DSS-13 Azimuth Wheel Fatigue Analysis

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Per your request, I evaluated the azimuth wheel axles on DSS-13 for fatigue life. As you are aware DSS-13 has a few features that make it somewhat different than the other BWG antennas. The main differences are that DSS-13 has a tripod sub-reflector support instead of a quadripod, the DSS-13 IRG weighs considerably less than the standard BWG's (29,000 lb vs. 95,000 lb), and DSS-13 has an alidade extension which was used for an offset BWG experiment. The total approximate weight (from engineering data) for DSS-13 is 874,000 lb vs. approximately 1,000,000 lb for the standard BWG antenna. The equipment for the offset BWG (i.e. feed assembly and BWG shroud tube) was never fully implemented and so the associated equipment weight (i.e. feed cone assembly and BWG shroud tube) was subtracted from the total weight and the wheel reactions adjusted accordingly. The new weight is now assumed at ~860,000 lb. The wheel loads were taken from the engineering data drawings (9493280). From this data it was noticed that certain wheels were loaded considerably more than other wheels. I believe this is caused by the extra weight of the alidade extension over the right rear wheel of the antenna. Because of the wide load variation I decided to examine each wheel axle individually and plot their 'operating point' on the constant life graph. As with the other analysis, we took a weighted average (rms) wheel load assuming 25% dead load only, 65% operation in 30 mph wind, and 10% operation in 70 mph wind.

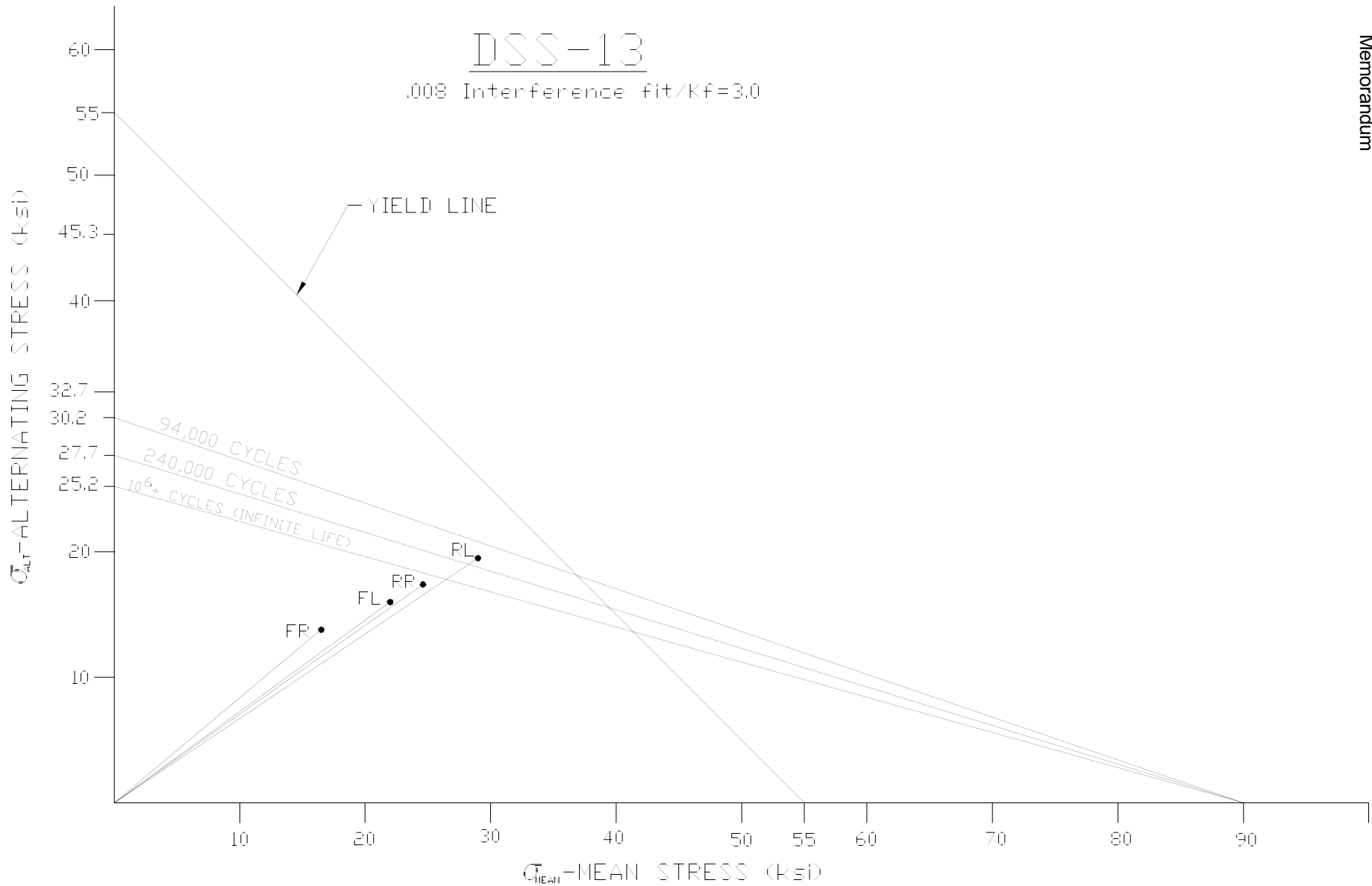
The number of cycles was estimated based on a 10 year operational life. Two estimate were made, one based on 1 track/day (94,000 cycles), the other on 2.5 tracks/day (240,000 cycles) which is the same duty cycle as the standard BWG. One 'track' is defined as 360 degrees of azimuth rotation. The constant life lines were then plotted on the fatigue chart and compared to the 'operating points'.

From the fatigue graph (see attached) we can see that three of the wheels are in the 'infinite life' region. The Fourth wheel (Rear Left) because of the increased load falls outside of the infinite life region yet is still below the estimated cycle life of the antenna. Based on the fatigue graph and the low duty cycle of DSS-13, there does not appear to be an immediate need for concern. The two wheels of greatest concern are the idler wheels, this makes an ultrasonic inspection of the axles a relatively easy process. It is my recommendation that an ultrasonic inspection of the idler axles be performed as soon as possible. If no indications of a crack are found, a yearly ultrasonic axle inspection should be incorporated into the maintenance program.

5/15/2001

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Memorandum



CONSTANT LIFE FATIGUE DIAGRAM  
1045 STEEL - 90ksi UT/55ksi YS